



... web driven nuclear science

Nuclear data Exercises

(A. Berlizov)

Exercises

Problems to be solved using the Decay Engine

1. The activity of ^{90}Sr is 18000 transformations per minute. What is the mass of ^{90}Sr ?
2. What mass of ^{226}Ra will yield the same activity as one milligram of ^{210}Po ?
3. At $t=0$ there are 10 Ci of ^{90}Sr . What will be the activity of ^{90}Y after 5 years?
4. What is the time required for the activity of ^{24}Na to diminish to 1% of its initial value?
5. What initial mass of ^{18}F is required in order that there are 3 mg remaining after 16 hours?
6. A sample contains 30 MBq of ^{210}Pb and 15 MBq of ^{210}Bi at time $t = 0$. If the sample was originally pure ^{210}Pb , then how old is it at time $t = 0$? Calculate the activity of ^{210}Bi at time $t = 10$ d.
7. An encapsulated ^{210}Po radioisotope is to be used as a heat source, in which an implanted thermocouple junction converts heat into electricity with an efficiency of 15% to power transmitter for a space probe. How many grams of ^{210}Po are needed at launch time if the transmitter is to be supplied with 100 W of electricity 1 y after launch? Calculate the activity of ^{210}Po needed.
8. Assume that at $t=0$ a ^{95}Zr source with a given activity is produced. Evaluate when: (i) the activity of a daughter nuclide ^{95}Nb will constitute 10% of the initial activity of ^{95}Zr , (ii) ^{95}Zr and ^{95}Nb activities will become the same. Make similar evaluation for the number of ^{95}Zr and ^{95}Nb nuclei.
9. Due to the Chernobyl fallouts in 1986 the radioactive contamination of the top soil by ^{137}Cs in a forest was 2 Ci/km^2 . What dose will be accumulated in subsequent 50 years by a man from the nearby village if in 2007 he consumed 200 g DW (dry weight) of mushrooms collected in the forest? Compare the value of the dose accumulated by the man with the annual reference dose limit for public. Assume the value of the transfer ratio $\text{TR} = 10 \text{ m}^2\text{kg}^{-1} \text{ DW}$ for the uptake of radio-cesium by the consumed type of mushrooms.
10. A freshly produced 1 g of ^{226}Ra has been stored temporarily in an unventilated room ($5 \times 5 \times 3 \text{ m}^3$). Evaluate the maximum potential radiation exposure due to the inhalation of short-lived ^{222}Rn progenies to the personal, which visited the room for 30 min 5 days after the placement of the source. Assume that the source packaging is not completely air-tight, allowing escape of about 1% of ^{222}Rn gas produced inside the source, which then instantaneously mixed up with the air. The radon concentration to dose rate conversion factor is $25 (\mu\text{Sv/y})/(\text{Bq/m}^3)$.